Technical Memorandum No. 5: Option Evaluation

Abstract

The purpose of this technical memorandum is to document the evaluation of the fourteen (14) alignment corridor options developed for the SR 504 Extension Feasibility Study. The option evaluation is based on the purpose and need for the project and the environmental, engineering, and economic evaluation criteria derived from the issues and expectations developed during meetings with the Technical Advisory Committee, Public Involvement Committee, and the general public.

Introduction

A list of project issues and expectations were developed for the SR 504 Extension Feasibility Study at the initial Technical Advisory Committee (TAC) meeting, the Public Involvement Committee (PIC) meeting and two public meetings. Issues and expectations were broken into three general categories: environmental, engineering, and economic. These issues and expectations are reflected in the project's purpose and need statement (see Technical memorandum No. 1). Evaluation criteria were then developed that addressed these issues and expectations for the proposed extension of SR 504. Evaluation criteria were then applied to each of the fourteen (14) alignment corridor options that were developed during the TAC meeting, the PIC meeting, and two public meetings. The option evaluation serves as a basis for the TAC to decide which option or options should be further developed and evaluated.

Options Evaluated

The initial set of alignment corridor options to extend SR 504 are grouped into three categories:

- Five options are being considered to connect to US 12 to the north
- Seven options are being considered to connect to Forest Road 25 to the east
- Two options are being considered to connect to Forest Road 90 (or SR 503-S) to the south

Each of these options is shown on Attachment No. 1 and is summarized below. More detailed descriptions of the alignment corridors are presented in Technical Memorandum No. 1.

Option 1

This option originates at the Hoffstadt Bluff Visitor Center and extends almost directly north connecting with US 12 near Mossyrock.

Option 2

This option originates at the Hoffstadt Bluff Visitor Center and extends in a northeasterly direction and ultimately ties into US 12 near Glenoma.

Option 3

This option originates at the Hoffstadt Bluff Visitor Center and extends in a northeasterly direction and ultimately ties into US 12 near Randle.

Option 4

This option originates at the Hoffstadt Bluff Visitor Center and extends in a northeasterly direction and ultimately ties into Forest Road 25 near Iron Creek Campground.

Option 5

This option originates at the Hoffstadt Bluff Visitor Center and extends in a northeasterly direction. After crossing the Green River, this alignment travels in a southeasterly direction connecting with Forest Road 26 and following Forest Road 26 ultimately ties into Forest Road 25 near Iron Creek Campground.

Option 6

This option originates 2 miles west of the Coldwater Ridge Visitor Center, extends in a northeasterly direction and ultimately ties into US 12 near Glenoma.

Option 7

This option originates 2 miles west of the Coldwater Ridge Visitor Center and extends in a northeasterly direction and ultimately ties into US 12 near Randle.

Option 8

This option originates 2 miles west of the Coldwater Ridge Visitor Center and extends in a northeasterly direction and ultimately ties into Forest Road 25 near Iron Creek Campground.

Option 9

This option originates 2 miles west of the Coldwater Ridge Visitor Center and extends in a northeasterly direction. After crossing the Green River, this alignment then travels in a southeasterly direction connecting with Forest Road 26 and following Forest Road 26 ultimately ties into Forest Road 25 near Iron Creek Campground.

Option 10

This option originates near the most easterly point of SR 504 near Johnston Ridge, and travels northeasterly to connect with Forest Road 26 and, following Forest Road 26, ultimately ties into Forest Road 25 near Iron Creek Campground.

Option 11

This option originates near the most easterly point of SR 504 near Johnston Ridge, and travels north of Spirit Lake connecting with Forest Road 99. The option would continue on Forest Road 99 connecting with Forest Road 25 at Wakepish.

Option 12

This option originates at a point just south of Coldwater Lake and travels southeasterly south of Spirit Lake, connecting to Windy Ridge, and follows Forest Road 99 back to Forest Road 25 at Wakepish.

Option 13

This option originates at a point just south of Coldwater Lake and extends directly south, ultimately connecting with Forest Roads 83 and 90 near the northwest end of Swift Reservoir

Option 14

This option originates at a point just south of Coldwater Lake, extending directly south to the vicinity of the Blue Lake trailhead. This alignment then turns southeasterly, and continues to the south connecting with SR 503-S near the town of Cougar.

Evaluation Process

Using the evaluation criteria identified during the TAC, PIC, and public meetings, the consultant team established means by which the criteria could be measured for each of the options. Given the preliminary nature of this investigation, the evaluation process was limited to a determination of whether an option would have (a) minimal impact/highest benefit, (b)

moderate impact or benefit, or (c) major impact/least benefit on a specific resource relative to the other options. Note that these are relative rankings based on preliminary data and one-mile wide alignment corridors, and do not represent a definitive impact evaluation of the 14 options.

Some of the proposed options would use existing roads for a portion of the alignment. This analysis assumed that the entire alignment would require new construction even if portions of it were on existing road.

Attachment No. 2 presents the results of the evaluation of the options based on the evaluation criteria. The following sections describe the specific measures used to evaluate the options against the evaluation criteria and how the relative ranking system of impacts/benefits was applied for each of the criteria.

Project Purpose and Need

Connecting East and West Sides

Definition. One of the primary purposes of the SR 504 Extension would be to provide a new loop route around the Mount St. Helens National Monument connecting the east and west sides.

Data Source. The source of information was regional mapping and the mapping of the proposed option corridors.

Evaluation. The option corridors were examined with respect to how well they connected outlying communities to Mount St. Helens attractions.

Loop Route Connection to Mount Rainier, Columbia River Gorge, and Eastern Washington

Definition. One of the primary purposes of the SR 504 Extension would be to provide a connection that would create a new loop route connecting Mount St. Helens with Mount Rainier, the Columbia River Gorge, and eastern Washington.

Data Source. The source of information was regional mapping and the mapping of the proposed option corridors.

Evaluation. The option corridors were examined with respect to how well they connected Mount St. Helens to other tourist attractions on the area.

Improve Economic Development Opportunities

Definition. One of the needs for connecting SR 504 with a state or federal road to the north, south, or east of the Mount St. Helens National Monument is to improve economic development opportunities in the area surrounding the National Monument.

Data Source. The results of the evaluation of the economic criteria demonstrating the opportunity for economic growth were used in the evaluation of this criterion.

Evaluation. The option corridors were evaluated based on the overall opportunities for economic development (i.e., based on the expected increase in tourism traffic) provided to the five counties in the study area.

Improve Resident Access

Definition. One of the needs for connecting SR 504 with a state or federal road to the north, south, or east of the Mount St. Helens National Monument is to improve resident access in the area surrounding the National Monument.

Data Source. The results of the evaluation of the economic criteria demonstrating the distribution of benefits to local resident travel were used in the evaluation of this criterion.

Evaluation. The option corridors were evaluated based on the distribution of benefits among local residents.

Improve Visitor Access

Definition. One of the needs for connecting SR 504 with a state or federal road to the north, south, or east of the Mount St. Helens National Monument is to improve visitor access in the area surrounding the National Monument.

Data Source. The results of the evaluation of the economic criteria demonstrating the distribution of benefits to recreation sites and monument attractions were used in the evaluation of this criterion.

Evaluation. The option corridors were evaluated based on the distribution of benefits for tourists.

Provide a Shorter Emergency Route

Definition. One of the needs for connecting SR 504 with a state or federal road to the north, south, or east of the Mount St. Helens National

Monument is to provide a new shorter emergency medical and law enforcement response route.

Data Source. The evaluation of this criterion was based on the results of the evaluation of the engineering criteria demonstrating impacts to access and travel patterns.

Evaluation. The option corridors were evaluated based on the efficiency of access between population centers and emergency response teams to Mount St. Helens National Volcanic Monument attractions on SR 504.

Provide Year-round Emergency Evacuation Route

Definition. One of the needs for connecting SR 504 with a state or federal road to the north, south, or east of the Mount St. Helens National Monument is to provide a year-round emergency evacuation route.

Data Source. The evaluation of this criterion was based on the results of the evaluation of the engineering criteria demonstrating the opportunity for year-round access.

Evaluation. The option corridors were evaluated based on whether the corridor could be maintained year-round.

Environmentally Acceptable

Definition. This criterion evaluates how construction and maintenance of the option would affect environmental resources.

Data Source. The evaluation of this criterion was based on the results of the evaluation of the environmental criteria.

Evaluation. The option corridors were evaluated based on the overall level of impact estimated to occur with respect to environmental resources.

Engineering Cost and Feasibility

Definition. This criterion evaluates the relative cost and engineering feasibility of the options.

Data Source. The evaluation of this criterion was based on the results of the evaluation of the engineering criteria associated with project costs, geotechnical elements, and topographic indicators.

Evaluation. The option corridors were evaluated based on the combined factors related to costs and feasibility of engineering design and construction.

Environmental Evaluation

Terrestrial Wildlife Resources and Habitat

Definition. Terrestrial wildlife resources and habitat impacts were evaluated using a combination of three parameters: (1) total acres of the alignment corridor, (2) number of acres in deer and elk wintering habitat, and (3) a qualitative evaluation of the location of the alignment corridor relative to contiguous parcels of open land.

Data Source. The location of wintering deer and elk habitat was mapped by Gifford Pinchot National Forest (GPNF) and provided in GIS format. Total areas of the alignment corridors (using the total length of the alignment) were determined from alignment concept drawings in GIS format. The assumption was made that number of acres required for the project is directly correlated to habitat impacts. The potential for any option to intersect a contiguous parcel of open lands was evaluated qualitatively using USGS and GPNF mapping. No habitat data were available for state and private lands.

Evaluation. The total number of acres that cross deer and elk wintering habitat for each option ranged from 0 to 4,219. Based on the numeric distribution of affected areas, the options that affected less than 407 acres were given a score of 1 (minimal impact), options that affected between 407 and 539 acres were given a score of 2 (moderate impact) and the options that affected more than 2,149 acres were given a score of 3 (major impact).

The total number of habitat impacts as indicated by the total acreage of the project ranged from 9,294 to 23,930. Based on the numeric distribution of affected areas, a score of 1 (minimal impact) was given to the options with a value between 9,000 and 15,000 acres, a score of 2 (moderate impact) was given to options affecting between 17,000 and 18,500 acres, a score of 3 (major impact) was given to options that affected more than 20,000 acres.

The contiguous parcel analysis was a qualitative evaluation that gave each option a score of 1, 2, or 3 based on its location relative to existing roads. Alignment corridors that would use existing roads or make short connections were given a score of 1 (minimal impact) and alignment corridors that cut though areas with minimal or no existing roads were given a score of 3 (major impact).

The scores for the three parameters were totaled and a straight average was calculated for each of the options. The options were ranked as having

minimal, moderate, or major impact for average scores of 1, 2, or 3, respectively.

Stream Alteration and Riparian Encroachment

Definition. Stream alteration and riparian encroachment would occur at major river and stream crossings. The number of such crossings was determined for each option. Rivers crossed included the Green, N. and S. Forks of the Toutle, Cowlitz, Kalama and Cispus. Stream crossings included smaller waterbodies such as Elk Creek, Cow Creek, and Quartz Creek.

Data Source. The river and stream information was provided by Washington State Department of Fish and Wildlife. This information was available on a GIS layer that included the location and name of the crossing.

Evaluation. The total numbers of rivers and streams crossed by an alternative alignment corridor were determined for each option. River crossings were given a 2 to 1 weighting and then a total weighted value was calculated for each option. For example if an alignment corridor crossed 4 rivers and 6 streams the total number of crossings was 14. This weighting system was used because some alignment corridors had a small number of total crossings, but the crossings were major rivers. The number of crossings for all of the options ranged from 14 to 60. Options that had less than 20 crossings would have a minimal impact. A mid-range ranking was given to options that had between 24 and 33 crossings. A major impact ranking was given to alignment corridors with between 47 and 60 stream and river crossings. The assignments of relative impacts were based on the numeric distribution of crossings for the 14 options.

Terrestrial Threatened and Endangered Species

Definition. Impacts to terrestrial threatened and endangered (T&E) species were evaluated using potential grizzly bear, lynx, wolf, and spotted owl habitat. T&E plants were not included in this preliminary analysis.

Data Source. Potential habitat for grizzly bear, lynx, and wolf and critical habitat for the spotted owl was determined and mapped by the GPNF in GIS format. No habitat data for T&E species were available for state and private lands.

Evaluation. The total acres of potential habitat for grizzly bear, lynx, and wolf and critical habitat for the spotted owl within the alignment corridor was calculated for each option. Spotted owl and lynx habitats were weighted at 3 to 1 because there are known occurrences of these species in

the area and the habitat may be occupied. Grizzly bear and wolf presence in the forest at this time has not been documented, so these criteria were not given additional weighting.

Options that cross less than 2,000 acres would have minimal impact. Options crossing 3,300 to 4,400 acres would have a moderate impact. Options crossing more than 7,700 acres would have a major impact. The assignments of relative impacts were based on the numeric distribution of affected areas for the 14 options. Because the available data for areas outside of GPNF was limited, the effects of Options 1, 2, 3, 6 and 7 on T&E species or habitat may be underestimated.

Aquatic Threatened and Endangered Species

Definition. The evaluation of relative impacts to aquatic threatened and endangered species was based on the number of times an alignment corridor crosses a watercourse with known historic presence of anadromous fish.

Data Source. The Washington Department of Fish and Wildlife has mapped the historic presence of anadromous fish in streams throughout the state. This coverage was used to determine the number of times each alignment corridor crossed a stream with known historic presence.

Evaluation. The alignment corridors that do not cross watercourses with anadromous species were considered to have minimal impact to these species. Alignment corridors that cross 5 to 15 watercourses with historic presence of anadromous fish were given a mid-range ranking and alignment corridors with 19 to 23 crossings of watercourses with historic presence of anadromous fish were given a major impact ranking. The assignments of relative impacts were based on the numeric distribution of affected watercourses for the 14 options.

Wetland Impacts

Definition. The potential impacts to wetlands were estimated by calculating the total number of wetland acres that an alignment corridor crosses. The type of wetland that an alignment corridor may cross was not evaluated at this time due to the preliminary nature of this analysis.

Data Source. National Wetland Inventory (NWI) information developed by the U.S. Fish and Wildlife Service in GIS format was used to estimate the impacts to wetlands.

Evaluation. The number of wetland acres affected by the 14 options ranged from 101 to 1,224. Based on the numeric distribution of affected areas for the 14 options, options affecting 200 or fewer acres would have

minimal impact; options affecting between 220 and 360 acres would have moderate impacts; and options affecting over 470 acres would have major impacts.

Impacts to Noise Sensitive Receptors

Definition. The evaluation of noise impacts considers how traffic noise generated by the project could affect sensitive noise receptors. Three factors are used in this evaluation. They are: (1) the amount of traffic that would be added to USFS and state roads; (2) the relative population densities on roads that would experience more traffic, relating greater population to greater number of sensitive receptors, and (3) the location of the road relative to the National Volcanic Monument.

Data Source. The measurement of noise impacts using these three factors is based on the results of the traffic analysis (Technical Memorandum No. 3), the locations of populated areas using state highway maps, and topographic maps of the study area including the alignment concept drawings.

Evaluation. The options were evaluated for the three factors as follows:

- Traffic Noise. Options that connect SR 504 directly to US 12 or to Forest Road 25 at Iron Creek Campground would result in a moderate impact to noise on those roads due to maximum traffic volumes of 550 to 880 vehicles per day. Options that connect SR 504 to Forest Road 25 at Wakepish or to SR 503 and Forest Road 90 to the south would result in a minimal impact to noise on those roads due to maximum traffic volumes of 400 to 700 vehicles per day and 250 to 450 vehicles per day, respectively. None of the options would result in a major impact to traffic noise.
- Noise Sensitive Receptors. Impacts to noise sensitive receptors would be moderate for options that connect SR 504 directly to US 12 or to Forest Road 25 at Iron Creek Campground (i.e., higher number of noise sensitive receptors) and minimal for options that connect SR 504 to Forest Road 25 at Wakepish or to or to SR 503 and Forest Road 90 (i.e., lower number of noise sensitive receptors). None of the options would have a major impact on noise sensitive receptors.
- Location Relative to Mount St. Helens. Options that are outside of the National Volcanic Monument property would have a minimal noise impact. Options that are within the National Volcanic Monument property and within 3 miles of an existing road would have a moderate noise impact. Options that are within the National Volcanic Monument property and more than 3 miles from an existing road would have a major noise impact.

For each category, minimal impact ratings were given a value of 1, moderate impact ratings were given a value of 3 and major impact ratings were given a value of 5. The results of these factor evaluations for each alternative were combined to determine overall noise impacts. Options with a total score of 5 was considered to have minimal noise impact, 7 was considered as moderate noise impact, and 11 was considered as a major noise impact.

Recreation Area Impacts

Definition. In addition to the options' affects on the economic aspects of recreation and access to recreation areas (addressed below), the direct effects on recreational resources were also evaluated. The relative affect of each option was based upon the following parameters: (1) the areas of land designated as "semi-primitive non-motorized," "semi-primitive motorized," and "primitive" in the GPNF Forest Plan within the alternative alignment corridor; (2) whether it crosses the Mount Margaret Backcountry; and (3) the number of crossings of existing recreational trails. These screening criteria were considered indicative of each alignment corridor's overall impact on recreational areas.

Data Source. GIS data layers from GPNF showing recreational area designations in the Forest Plan and recreational trails were used. A map of the Mount Margaret Backcountry provided by GPNF was also used.

Evaluation. The evaluation was based on the area of semi-primitive non-motorized lands crossed by each alternative alignment corridor. [The alternative alignment corridors cross no semi-primitive motorized or primitive areas.] Since the management objective for these lands is to maintain a predominantly natural environment for recreational users, options with a relatively large area affected (in comparison to the other options) were considered to have a major impact on recreation resources and those options with no area affected were considered to have a minimal impact. Options that cross the Mount Margaret Backcountry area were considered to have a major impact.

Potential roadway crossings of existing trails were considered to have an adverse effect on recreational resources. Therefore, those options that had relatively high numbers of trail crossings were considered to have major impacts on recreational resources; those options with no or relatively few crossings were deemed to have minimal impacts.

Historic Properties

Definition. Historic properties inventoried in this evaluation are physical manifestations of human activities that are included in or eligible for inclusion in the National Register of Historic Places.

Data Sources. USFS and Washington State Historic Preservation Office records were used for this evaluation. Two sites adjacent to the study area are listed in the NRHP and the Washington Heritage Register. These sites are the Randle Ranger Station - Work Center and the North Fork Guard Station No. 1142, both located in the GPNF.

Evaluation. Each of the alternative alignment corridors was evaluated considering potential effects on listed historic properties. None of the alignment corridors would potentially affect the listed historic properties; therefore, all were considered to have minimal impacts on historic resources. This is a very preliminary assessment and does not indicate that the alignments would not affect cultural resources. A more detailed analysis of potentially affected properties would be conducted for any preferred option or options.

Visual Impacts

Definition. The evaluation of visual impacts measures the relative impact of the new roadway alignment on the aesthetic quality of the project area.

Data Source. The determination of visual impacts is based on the location of the option relative to the National Volcanic Monument property and relative to Mount St. Helens.

Evaluation. Options that are outside of the National Volcanic Monument property are characterized as having minimal visual impact. Options that are within the National Volcanic Monument property but not within the viewshed of Mount St. Helens from a visitors' center are characterized as having moderate visual impact. Options that are within the National Volcanic Monument property and within the viewshed of Mount St. Helens from a visitors' center are characterized as having major visual impact.

GPNF Roadless Areas

Definition. Roadless areas are designated in the GPNF Forest Plan EIS (1990) to protect resources and limit roadbuilding and associated activities in unsuitable locations.

Data Source. GIS data layers of roadless areas as designated by the GPNF Forest Plan were used for this evaluation.

Evaluation. The total acreage of roadless areas that an alignment corridor crosses was calculated for each option. The number of roadless acres impacted ranged from 0 to 2,500. Alignment corridors that would affect less than 100 acres of roadless areas would have a minimal impact. Alignments that would affect between 100 and 250 acres of roadless areas would have a moderate impact, and alignments that would affect 900 or more acres would have a major impact. The relative ranking of the options is based on the numeric distribution of affected areas for the 14 options.

Late Successional Reserves

Definition. Late Successional Reserves (LSRs) are land allocations designated to protect and enhance late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species, including the northern spotted owl.

Data Source. GIS data layers of LSR areas were used for this evaluation.

Evaluation. The total acres of LSRs crossed by an alternative alignment corridor was calculated for each option. This evaluation only produced three acreage calculations for all options: 0, 971 and 2,268. The options were then easily broken into three ratings of minimal, moderate, and major impacts, respectively.

Consistency with National Volcanic Monument Plan

Definition. The Mount St. Helens National Volcanic Monument Comprehensive Management Plan (CMP) provides specific management concept areas within the National Volcanic Monument and provides objectives for management within the National Volcanic Monument. In general, the Monument was established to protect the scientific and natural values associated with Mount St. Helens.

Data Source. The GIS data layer of the Mount St. Helens National Volcanic Monument boundary was used in conjunction with maps of existing and historic roads within the study area.

Evaluation. According to the USFS (letter from Claire Lavendel, Forest Supervisor, GPNF, to Terry Buchholz, Project Manager, HDR, December 22, 2000), proposed roads that do not already exist in the National Volcanic Monument are in conflict with the National Volcanic Monument CMP. Based on this information, options that require new road

construction within the Monument boundary would have a major impact on the CMP and options that do not cross within the Monument would have a minor impact on the CMP.

Impacts on National Volcanic Monument Scientific Research

Definition. A major component of the Mount St. Helens National Volcanic Monument is its value to scientific research. Geologic monitoring stations have been established throughout the National Volcanic Monument to aid in the scientific research of volcanism and other geologic processes.

Data Source. The GIS data layer of the geologic units within the Mount St. Helens National Volcanic Monument boundary was used in conjunction with the map showing the option alignment corridors.

Evaluation. The introduction of a road and vehicular traffic to pristine areas of the National Monument could jeopardize the scientific research of natural processes in the aftermath of the 1980 eruption. By creating access to areas that have been relatively undisturbed by human contact since 1980, non-native species could be inadvertently introduced to these areas and disrupt the natural progression.

Alignments that do not enter the National Volcanic Monument would have minimal impact on scientific research at the Monument. Alignments that fall within the National Volcanic Monument but do not traverse geologically sensitive areas (e.g., the Pumice Plain, mudflow areas, and ash flow areas) would have a moderate impact on scientific research. Alignments that fall within the National Volcanic Monument and traverse geologically sensitive areas would have a major impact on scientific research.

Engineering Evaluation

Capital Costs

Definition. Capital costs are the costs associated with construction of the roadway, including land preparation, material, equipment, and labor costs. The capital costs derived for this evaluation represent a relative perspective of project costs for the 14 options.

Data Source. Information on geotechnical hazards, river/stream crossings, and grades was derived from GIS and USGS quad maps. Costs for each option were derived from unit costs that were based on previous construction costs for SR 504 supplied by WSDOT and alignment length.

Evaluation. Capital costs were calculated by applying the unit cost for construction (i.e., a standard cost per mile) to the estimated roadway lengths for each alternative. The portions of USFS roads (Forest Roads 26, 81, 99) that are specific to a particular option were also included in the calculation because these road segments would be reconstructed as part of the new alignment. Because Forest Roads 25 and 90 would be upgraded to the same standards under all of the alternatives, costs associated with these upgrades were not included in the capital cost estimates. Terrain conditions, such as geotechnical hazards, river/stream crossings, and grades, were also analyzed since these factors increase the difficulty of construction and require additional roadway elements, which all increase the cost of construction[1]. The relative effect of each factor was used to associate a corresponding increase in the base cost.

The total capital costs were divided into three sets. The lowest cost alignment was around $80 million and was assigned a ranking of least costly, while the next range of costs fell between $100 million to $150 million and were assigned a cost ranking in the mid-range. Costs above $180 million were considered most costly.

Operation and Maintenance Costs

Definition. Operation and maintenance costs are the costs associated with snow removal activities and other activities related to keeping the roadway in a safe, useable condition. Examples include restriping, regrading, removing obstructions, clearing vegetation, and replacing missing or faulty roadway elements such as barriers and guardrails.

Data Source. Unit costs per length of snow removal and non-snow removal activities were based on previous costs at White Pass supplied by Washington Department of Transportation (WSDOT). Alignment lengths were estimated from the conceptual drawings. Elevation information was obtained from the GIS database and USGS quad maps.

Evaluation. Operation and maintenance costs were evaluated based on the total cost for snow removal and overall non-snow removal activities (referred to as other costs). The total length of the proposed alignment, including existing roadways, was considered for this analysis. Snow removal was considered for elevations greater than 2,500 feet. The cost was computed by multiplying a unit cost by the length of the alignment with an elevation over 2,500 feet. The total length of the alignment, including the areas considered in snow removal, was used to compute the other costs of operation and maintenance.

Operation and maintenance costs were ranked based on the sum the annual snow removal and other costs. Annual costs of $500,000 or less were

[1] For analysis, see sections on Geotechnical Hazards, Bridges, and Topographic Indicators.

assigned low relative costs (least costly), between $500,000 to $750,000 were assigned moderate relative costs (mid-range), and over $750,000 were assigned high relative costs (most costly).

Access/Travel Patterns Impact

Travel Patterns to Randle

Definition. This analysis evaluated the time it takes to travel along each of the options to Randle.

Data Source. Alignment lengths were estimated from the conceptual drawings. Existing speed limits were used to calculate travel times.

Evaluation. Travel Patterns were evaluated by comparing the time to travel from Hoffstadt Bridge through the alignment corridor to Randle. The distances through these routes were divided by the speed limit to calculate travel times. For each option, a design speed of 45mph was assumed. Travel times to Randle were ranked by those under 1 hour (highest benefit), between 1 and 1.5 hours (moderate benefit), and those above 1.5 hours (least benefit).

Travel Patterns to Cougar

Definition. This analysis evaluated the time it takes to travel along each of the options to Cougar.

Data Source. Alignment lengths were estimated from the conceptual drawings. Existing speed limits were used to calculate travel times.

Evaluation. Travel Patterns were evaluated by comparing the time to travel from Hoffstadt Bridge through the alignment corridor to Cougar. The distances through these routes were divided by the speed limit to calculate travel times. For each option, a design speed of 45mph was assumed. Travel times to Cougar were ranked by those under 1 hour (highest benefit), between 1 and 3 hours (moderate benefit), and those above 3 hours (least benefit).

Year-round Accessibility

Definition. Access impacts refer to the accessibility of the roadways during all seasons.

Data Source. Elevation information was obtained from the GIS database and USGS quad maps. Assumptions about accessibility at various elevations were made based on year-round accessibility at other passes in the Cascade Mountains.

Evaluation. Access impacts were evaluated based on the height of the passes. Alignments with passes below 3,000 feet were considered accessible year-round. The effects of snow and ice were not considered a large factor under this elevation; therefore, options with passes below 3,000 feet would have the highest benefit in terms of accessibility. At elevations between 3,000 to 4,500 feet, weather conditions were considered to moderately influence the usability of the road resulting in a moderate impact on accessibility. Snow accumulations may make the roads difficult to drive in or may close them down. Alignments at elevations greater than 4,500 feet were assumed to amass large amounts of snow over an extended period of time so these options would close down frequently, resulting in the least benefit in terms of accessibility.

Geotechnical Elements

Definition. Geotechnical Elements are features associated with unstable land conditions. Examples would include areas with landslides, unconsolidated soil, mudflows, flood damage, and the pumice plain.

Data Source. Areas containing geotechnical elements were identified from GIS database.

Evaluation. Due to the incomplete level of information outside the monument, geohazards were based on the following assumptions:

- Alignment corridors through the pumice plain and mudflow areas were considered of major impact due to uncompacted, unstable soil conditions.
- Alignments through Forest Road 26 were considered to have a major relative impact. From observation, this road contains flood damage and is difficult to drive through.

The remaining alignments are assumed to be in conditions better than those mentioned above. Therefore, they are considered of no or minimal relative impact.

Number of Bridges

Definition. The evaluation assumed all stream and river crossings by an alignment corridor would require a bridge. Crossings located on existing roadways were not included.

Data Source. Stream and river crossings were identified from GIS maps.

Evaluation. The number of bridges was estimated by counting the number of stream and river crossings for each alignment. Options with less than 10 bridges were ranked as having minimal impact, those with 10 to 15

bridges as having moderate impact, and those with more than 15 bridges as having major impact.

Right-of-way Acquisition

Definition. Right-of-way acquisition refers to land that would have to be purchased in order to build the road.

Data Source. Land ownership information was extracted from the GIS database.

Evaluation. Right-of-way acquisition was divided into four subcategories based on ownership. The length of the new alignment in each of the ownership categories was measured to determine the impact.

The ratings for each of the ownership categories was as follows:

- National Volcanic Monument - Options with no roadway within the National Volcanic Monument were ranked as having minimal impact, options crossing less than 10 miles of National Volcanic Monument property would have a moderate impact, and options crossing more than 10 miles of National Volcanic Monument property would have a major impact.
- GPNF (Outside of the National Volcanic Monument) - Options with no roadway were characterized as having minimal relative impact, and those with less than 10 miles of roadway in GPNF would have a moderate impact. There were no options with greater than 10 miles of roadway through GPNF land.
- Washington Department of Natural Resources (WDNR) - Options were characterized as having minimal or moderate relative impact: those with no roadway within WDNR property would have minimal impact and those with less than 10 miles of roadway within WDNR property would have a moderate impact. There were no options with greater than 10 miles of roadway through WDNR land.
- Private Land - Options with no roadway within private land would have minimal impact, options crossing less than 10 miles of private property would have a moderate impact, and options crossing more than 10 miles would have a major impact.

Topographic Indicators

Grades Over 10 Percent

Definition. The steepness of the terrain is a topographic indicator. This evaluation identified areas with gradients of over 10 percent.

Data Source. Information on topography was obtained from the GIS database and USGS quad maps.

Evaluation. Options having grades over 10 percent at 3 or fewer locations would have minimal impact, at 4 locations would have a moderate impact, and at 5 or more locations would have a major impact.

Number of Passes

Definition. The number of mountain passes (i.e., crossings) along an option corridor is a topographic indicator. This evaluation identified the number of passes within each option corridor.

Data Source. Information on topography came from GIS and USGS quad maps.

Evaluation. Options with one or fewer passes in the alignment corridor would have minimal relative effect; those with two passes would have a moderate relative effect, and those more than two passes would have a major relative effect.

Economic Evaluation

Opportunity for Economic Growth

Definition. The opportunity for economic growth was evaluated for the five counties that would be most directly affected by extending SR 504. The five counties that were evaluated were Clark, Cowlitz, Lewis, Skamina, and Yakima. The opportunity for economic growth was ranked based upon the expected increase in tourist traffic, which was assumed had potential to stimulate economic growth. More traffic would equate to more opportunity for economic growth.

Data Source. The ranking of opportunity for economic growth relied upon "Technical Memorandum No. 3: Traffic Analysis" for projections of changes in traffic volume. This information was used together with a map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument.

Evaluation. The level and origin of projected traffic was evaluated with respect to the alternative alignment corridor and the connection between counties using the above data sources. Counties most directly affected (i.e., could expect more traffic) were deemed most likely to capture more tourist related business and thus have a greater opportunity for growth (i.e., highest benefit). Counties least directly affected were deemed least likely to capture more tourist-related business and thus have a lesser opportunity for growth (i.e., least benefit). Counties moderately affected (i.e., could expect some traffic) were deemed moderately likely to capture

more tourist related business and thus have a moderate opportunity for growth. For example, for Clark County options 1 through 12 were judged to have about the same effect on the county and would be least beneficial to stimulate economic growth. Option 13 was judged to be moderately beneficial and option 14 the most beneficial of the options for stimulating economic growth in Clark County.

Distribution of Benefits

Increased Access: Local Resident Travel

Definition. Local residents would benefit from increased access to Coldwater Ridge Visitors Center (CRVC), both as visitors (recreation benefits) and as employees (income).

Data Source. The ranking of increased access for local resident travel relied upon "Technical Memorandum No. 4: Current Economic Patterns and Trends" for identifying population centers. This information was used together with a map of optional route locations and the U.S. Forest Service (USFS) administrative use map of Mount St. Helens National Volcanic Monument.

Evaluation. The population centers were evaluated with respect to the alternative alignment corridors and the connection with CRVC using the above data sources. The more direct the access between population centers and CRVC, the greater the impact of the option. Options providing the most direct connection were rated as having the highest benefit. Options providing a less direct connection were rated as having moderate benefit. Options providing the remote or minimal connection were rated as having the least benefit.

Increased Access: Public Land Management

Definition. Increased access would allow public (USFS) land managers to more effectively carry out their land management activities. Connection of USFS roads to an option would benefit public land management activities. With less travel time, more sites can be visited in a given amount of time, improving resource protection and public service.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. The USFS road system was evaluated with respect to the alternative alignment corridors and the connection between existing Forest Service roads. Options connecting more roads were rated as having the highest benefit. Options connecting a moderate number of roads were

rated as having a moderate benefit. Options connecting fewer roads were rated as having least benefit.

Increased Access: Public Safety

Definition. Increased access allows public safety (e.g., fire, medical, rescue, law enforcement, etc.) personnel to more effectively carry out their activities, increasing the service level provided to the public. With less travel time, response time for public safety activities is reduced, providing a higher level of service and benefit to the recipients of the service.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access from areas supplying public safety services with the option. Options providing greater access for public safety services were rated as having the highest benefit. Options providing moderately improved access were rated as having a moderate benefit. Options providing no/minimal additional access were rated as having least benefit.

Increased Access: Recreation Sites

Definition. Increased access allows the public to more easily get to campgrounds, trail heads, interpretive centers, etc. This would provide more access by a different segment of the recreating public and provide increased recreational benefits to them. Connection of USFS roads to an option would benefit recreational use in the area.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access from those areas supplying access to campgrounds, trail heads, interpretive centers, etc. Options providing greater access to campgrounds, trail heads, interpretive centers, etc. were rated as having the highest benefit. Options providing moderately improved access were rated as having a moderate benefit. Options providing no/minimal additional access were rated as having least benefit.

Increased Access: Monument Attractions.

Definition. Increased access allows the public to more easily get to major attractions, vistas, and visitor centers associated with Mount St. Helens

Volcanic National Monument, providing benefits by enhancing the opportunity for the public to visit these sites.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access to major attractions, vistas, and visitor centers. Options providing the most direct access were rated as having the highest benefit. Options providing moderately improved access to major attractions, vistas, and visitor centers were rated as having a moderate benefit. Options providing no/minimal additional access were rated as having least benefit.

Reduced Travel Costs: Local Residents

Definition. Local residents would benefit from reduced travel costs provided by the connecting options compared to existing roads. Route 12, SR 503, and Coldwater Ridge Visitors Center were the primary origin-destination sites assessed.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in travel costs from Route 12 and SR 503 to Coldwater Ridge Visitors Center. Costs were assumed to vary with travel distance from the origins to the destination. Options providing greater reduced travel distance were rated as having the highest benefit. Options providing moderately reduced travel distance were rated as having a moderate benefit. Options providing no/minimal reduction were rated as having least benefit.

Reduced Travel Costs: Public Land Management

Definition. Costs of public land management could be reduced by the options as a result of increasing the efficiency of performing land management activities, both by cost savings in reduced time to perform activities because work sites would be closer to roads and because of reduced costs of traveling to work sites. This could also mean accomplishing more work within existing budgets.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the potential change in public land management costs. Increased access was assumed to reduce management costs. Options providing greater reduced public land management costs were rated as having the highest benefit. Options providing moderately reduced costs were rated as having a moderate benefit. Options providing no/minimal cost reduction were rated as having least benefit.

Reduced Travel Costs: Public Safety

Definition. Public safety entities (e.g., fire, ambulance, law enforcement) may experience reduced costs of providing services to the public as a result of the SR 504 connection.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the option corridors and the potential for reduced costs of supplying public safety services with the option. It was assumed that more direct access would reduce travel time and costs. Options providing greater reduced costs of supplying public safety services were rated as having the highest benefit. Options providing moderately reduced costs were rated as having a moderate benefit. Options providing no/minimal cost reduction were rated as having least benefit.

Reduced Travel Costs: Tourists

Definition. This evaluation criterion measures the reduction in the cost for tourists travelling between Mount Rainier and Mount St. Helens, between the Columbia River Gorge and Mount St. Helens, and between SR 503 and Mount St. Helens.

Data Source. The map of optional route locations, the future traffic analysis, and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps and the traffic analysis, the existing road system was evaluated with respect to the alternative alignment corridors, the expected future traffic, and the cost reduction for tourists traveling to Mount St. Helens. Travel distance was assumed to be directly related to travel costs. Options providing greater reduced costs for tourists traveling to Mount St. Helens were rated as having the highest benefit. Options providing moderately reduced costs were rated as having a moderate benefit. Options providing no/minimal cost reduction were rated as having least benefit. Options that had larger traffic volumes were

considered to have higher benefit, while options with lower traffic volumes were considered to have least benefit.

Reduced Travel Costs: Private Landowners and Forest Industry

Definition. The options provide differing degrees of potential cost reductions for major private landowners and forest industry, including the movement of forest resources to processing facilities.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the reduction in costs for major private landowners and forest industry. Options providing greater reduced costs were rated as having the highest benefit. Options providing moderately reduced costs were rated as having a moderate benefit. Options providing no/minimal cost reduction were rated as having least benefit.

Distribution of Costs

Road Construction, Operation, and Maintenance: Local, State, and Federal

Definition. This criterion measures the expected share of project costs that would be borne by different levels of government. It is intended to be contrasted with the geographical distribution of opportunities for economic growth among the five counties: Clark, Cowlitz, Lewis, Skamania, and Yakima.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. The existing road system was evaluated with respect to the expected costs of roads in the alternative alignment corridors and the anticipated cost sharing. It assumes that state and federal government would provide a major share of road costs outside of the National Forest property, and the federal government would incur increased costs for roads within the National Forest. Roads involving more construction or reconstruction using Forest Service lands and existing Forest Service alignments will result in greater costs to the federal government. Options providing higher cost shares were rated as most costly to an entity. Options providing moderate cost sharing to an entity were rated as having

a moderate cost. Options providing no/minimal cost sharing to an entity were rated as least costly.

Access: Private Land Management and Protection

Definition. This criterion measures changes in costs of managing/protecting resources and possible environmental degradation due to increased access from the options.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access to private lands. Options increasing access from existing conditions were judge to provide increased risk to private resources and increased risk for environmental damage. Options providing greater access and increased risk to private resources and increased risk for environmental damage were rated as most costly. Options providing moderately improved access were rated as having moderate cost. Options providing no/minimal additional access were rated as least costly.

Access: Public Safety

Definition. Increased access may increase the potential need for public safety services and the costs associated with providing these services. More people are likely to enter areas not previously easily accessed, increasing the occurrence for incidences requiring public safety services.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access. Increased access was judged to increase the potential need for public safety services and their costs. Options providing greater access were deemed to increase the demand for public safety services and were rated as most costly. Options providing moderately improved access were rated as having moderate costs. Options providing no/minimal additional access were rated as least costly.

Access: Public Land Management and Protection

Definition. More access increases the risk of environmental and resource damage on lands previously easily accessed, requiring the Forest Service

to respond and raising costs to USFS associated environmental and resource protection.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access to USFS lands not currently readily accessible. Options providing greater access were deemed to increase the Forest Service to respond and raising costs to USFS associated environmental and resource protection were rated as most costly. Options providing moderately improved access were rated as having moderate cost. Options providing no/minimal additional access were rated as least costly.

Access: Recreation Visitor Congestion

Definition. People value National Forest lands for both the enjoyment they provide from actual visits to them and also value them for just knowing that they are there and protected for the future. Increased access can result in perceived loss of value (cost) to local users and non-users due to increased congestion and use and a perception that they may be used in a manner not consistent with the values held by some.

Data Source. The map of optional route locations and the USFS administrative use map of Mount St. Helens National Volcanic Monument were used.

Evaluation. Using the above maps, the existing road system was evaluated with respect to the alternative alignment corridors and the change in access. It was assumed that improved access to areas currently not easily accessed would impose a loss of value (cost) to some individuals. Options providing greater access were rated as having the greatest loss of value (most costly). Options providing moderately improved access were rated as having a moderate loss of value (moderate cost). Options providing no/minimal access were rated as having no/minimal loss of value (least costly).